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EFFECTS OF SEASON AND INTENSITY OF GRAZING ON
LEHMANN LOVEGRASS AND CATTLE PRODUCTION

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FINAL REPORT TO USDA FOREST SERVICE

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Project Identification

MEMORANDUM OF UNDERSTANDING NO. MU-66

SPONSOR NO. - RM-81-198-CA

AWARD DATE - 08/13/81

TERMINATION DATE - 10/31/87

TITLE - Effects of Season and Intensity of Grazing on Lehmann Lovegrass and Cattle Production

LOCATION - Pasture 12C, Santa Rita Experimental Range

COOPERATORS - University of Arizona, Department of Animal Science and School of Renewable Natural Resources, William A. McGibbon, and USDA, Forest Service Rocky Mountain Forest and Range Experiment Station

PREPARED BY - Phil R. Ogden, Professor of Range Management

Brief History of Project

Spring, 1982 - 2 miles of water line and storage tank installed.

Fall, 1982 - fences for initial six pastures and center alley completed.

December 22, 1982 - 118 cows allocated to pastures.

Pasture 1 - Yearlong - 20 head

Pasture 2 - Yearlong - 23 head

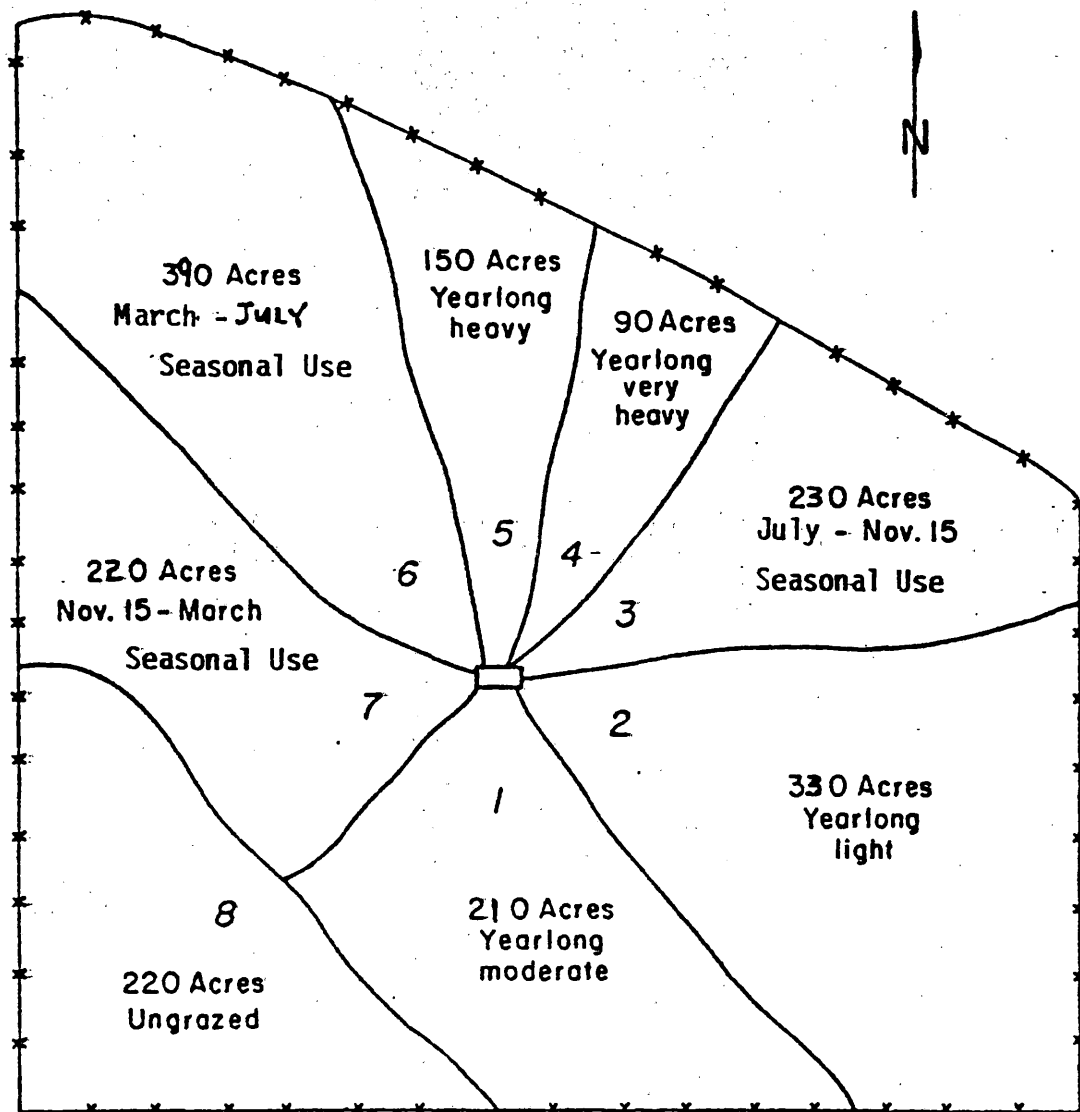
Pasture 3 - Yearlong - 22 head

Pasture 4, 5, and 6 - Seasonal - 50 head

Spring, 1983 - Construction of working corrals.

December, 1983 and January, 1984 - Design of study was changed to provide for intensities of yearlong grazing with a very heavy use added. Original Pasture 4 was divided to make Pastures 4 and 5 as shown in Figure 1. Twenty heifers were added and pasture treatments and cows reassigned as shown in Table 1.

January, 1984 to November, 1987 - Four pastures were grazed yearlong and three pastures were grazed seasonally at the grazing intensities and dates as shown in Table 1. Cows were weighed and condition scored at spring branding and fall weaning. Calves were weighed at fall weaning.



LEHMANN LOVEGRASS GRAZING RESEARCH

Pasture layout and proposed treatments
Santa Rita Experimental Range

Fig. 1

Table 1. Mean annual stocking rates for four grazing intensities with yearlong grazing and seasonal rotation treatment for Lehmann lovegrass grazing study on The Santa Rita Experimental Range, 1983-1987.

Dates	Yearlong Grazing Intensity and Pasture Number				Season of Use and Pasture Number			
	Light	Moderate	Heavy	Very Heavy	Summer	Spring	Winter	Mean
	-----	-----	-----	-----	-----	-----	-----	
	#2	#1	#5	#4	#3	#6	#7	
(AUY/Section)								
Nov. 10, 1983 to Nov. 15, 1984	36	58	49	81	51	33	55	44
Nov. 15, 1984 to Nov. 20, 1985	38	56	55	96	66	26	40	41
Nov. 20, 1985 to Nov. 13, 1986	34	46	50	38* (63)	46	37	40	40
Nov. 13, 1986 to Nov. 12, 1987	30	44	46	35* (50)	35	34	50	38
	--	--	--	--	--	--	--	--
Mean	34	51	50	62	50	32	46	41

* Actual stocking rate--pasture was unable to sustain the planned stocking rates as shown in parentheses. Cows were removed in both the spring of 1986 and 1987 in poor condition and returned to the pasture after forage regrowth with summer rains.

Utilization and plant frequency data were collected on the pastures in fall, 1984; spring, 1985; fall, 1985; and fall, 1987.

Continuing Activities - 1988

Nov. 12, 1987 - At fall weaning, 51 cows into Pasture 7. They were moved to Pasture 6 in late February or early March and stayed until May 11. The 10 cows remained in Pasture 5 during the November to May period.

May 11, 1988 - 51 cows and 21 calves were rounded up from Pasture 6, 9 open or late calving cows were culled. 42 cows and 21 calves turned into Pasture 1. Average cow weight (n=51) 861 pounds and average condition score (n=51) 10.1.

10 cows and 1 calf in Pasture 5. One cow culled and 9 cows left in pasture. Average cow weight (n=9) 972 pounds and average condition score (n=9) 11.3.

June 14, 1988 - 42 cows and their calves moved from Pasture 2 to Pasture 7.

July 11, 1988 - 42 cows and their calves rounded up from Pasture 7. Cows randomly assigned to two groups, weighed and ear tagged. 21 orange tag cows to Pasture 3, average weight - 832 pounds, s=130; 21 yellow, white, blue, or green tag cows to Pasture 2, average weight - 888 pounds, s=95.

Livestock Production Data

Pounds live weight of weaned calves produced by year for each of the five treatments are shown in Tables 2 and 3. Both pounds of calf weaned per acre (Table 2) and average calf weight (Table 3) declined over the period of the study, 1984 to 1987. There also was a general decrease in percentage calf crop during the study period for all treatments (Table 4). Percentage calf crop was poorest for the very heavy grazing treatment but was not significantly different from the other grazing treatments. The seasonally rotated cows produced the lightest average weaned calf weights (Table 3) with the cows subjected to very heavy yearlong grazing also producing light calves.

Annual percentage cow death loss varied greatly over years and among pastures with the highest death loss for cows under heavy and very heavy yearlong grazing (Table 5).

Only very poor, non-reproductive and sick cows were culled from the study animals (Table 6) to allow the cumulative effect of grazing treatments to become evident. The cumulative effect of this low culling rate was to allow late calving cows to remain in the herds. A major reason for light weight calves in the latter years of the study (Table 7) was that cows under all treatments tended to breed later each year until in 1987 many calves were born after May branding.

Figures 2 and 3 show the mean annual pounds of weaned calf production per section and per animal unit year for the five treatments for the four

Table 2. Pounds of calves (live weight) weaned per acre from Lehmann lovegrass grazing study pastures, 1984-87.

Date	Yearlong Grazing Intensity				Rotated Seasonal Use
	Light	Moderate	Heavy	Very Heavy	
Nov. 15, 1984	33	36	32	58	24
Nov. 20, 1985	26	44	37	40	24
Nov. 13, 1986	19	27	24	18*	17
Nov. 12, 1987	15	20	27	15*	17
Mean	23	32	30	33	20

* Calf weights adjusted to represent proportion of year that cows actually grazed on the very heavy pasture.

Table 3. Average calf weight as pounds live weight at weaning from Lehmann lovegrass grazing study pastures, SRER, 1984-87.

Date	Yearlong Grazing Intensity				Rotated Seasonal Use
	Light	Moderate	Heavy	Very Heavy	
Nov. 15, 1984	636	540	476	439	463
Nov. 20, 1985	498	542	500	398	445
Nov. 13, 1986	426	524	406	406	354
Nov. 12, 1987	432	456	407	416	380
Mean	498	516	447	415	410

Table 4. Percentage calf crop at weaning based on number of cows on treatments after previous fall culling and cow replacement for Lehmann lovegrass grazing study, SRER, 1984-87

Date	Yearlong Grazing Intensity				Rotated Seasonal Use
	Light	Moderate	Heavy	Very Heavy	
Nov. 15, 1984	85.0	77.8	76.9	92.3	89.6
Nov. 20, 1985	94.4	100.0	84.6	69.2	95.8
Nov. 13, 1986	93.8	73.3	81.8	85.7	78.0
Nov. 12, 1987	66.7	64.3	100.0	57.1	72.0
Mean	85.0	78.8	85.8	76.1	83.8

Table 5. Annual percentage cow death loss on Lehmann lovegrass grazing study, SRER, 1984-87.

Date	Yearlong Grazing Intensity				Rotated Seasonal Use
	Light	Moderate	Heavy	Very Heavy	
1/84 - 11/84	5.0	--	--	--	2.1
11/84 - 11/85	--	--	15.4	7.7	--
11/85 - 11/86	--	--	--	--	--
11/86 - 11/87	--	--	10.0	14.3	2.0

Table 6. Annual percentage of cows culled from each treatment of Lehmann lovegrass grazing study, SRER, 1984-87.

Date	Yearlong Grazing Intensity				Rotated Seasonal Use
	Light	Moderate	Heavy	Very Heavy	
1/84 - 11/84	--	5.6	--	--	2.1
11/84 - 11/85	5.6	--	--	23.1	14.6
11/85 - 11/86	6.2	6.7	9.1	--	12.0
11/86 - 11/87	66.7	28.6	30.0	28.6	34.0

Table 7. Annual means for all cattle on Lehmann lovegrass grazing study, SRER, 1984-87.

Attribute	Year			
	1984	1985	1986	1987
<u>Percentage Calf Crop</u>				
	85.7	91.7	80.8	71.9
<u>Average Weaned Calf Weight</u>				
	511	477	423	418
<u>Mean Weaned Calf Weight per AU</u>				
	442	403	323	309
<u>Percentage Cow Death Loss</u>				
	1.8	2.8	0	3.1
<u>Percentage Cows Culled</u>				
	1.8	10.1	9.1	37.5

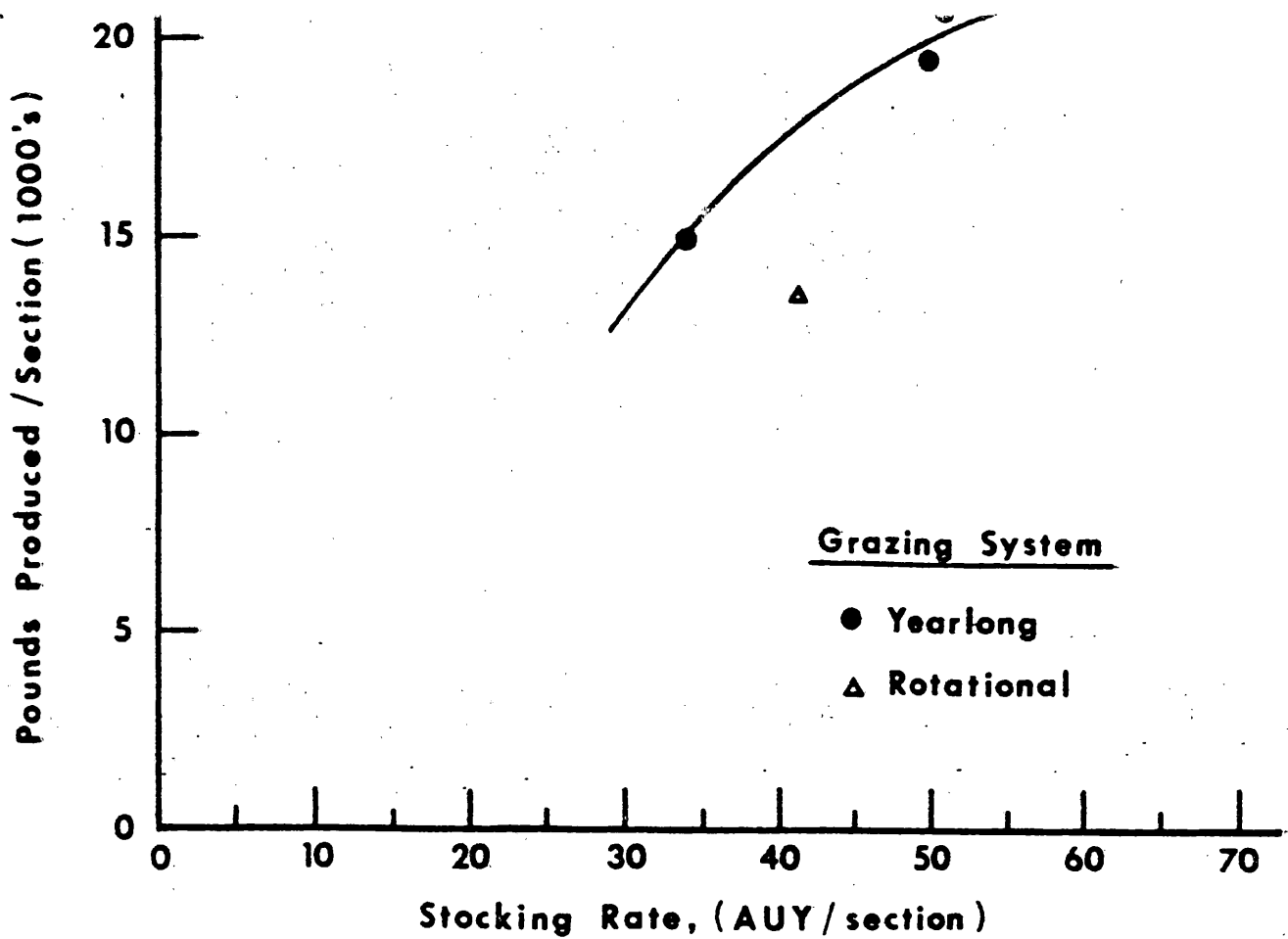


Fig. 2. Mean annual pounds of weaned live weight calf production per section for four years, from Nov. 1984 to Nov. 1987.

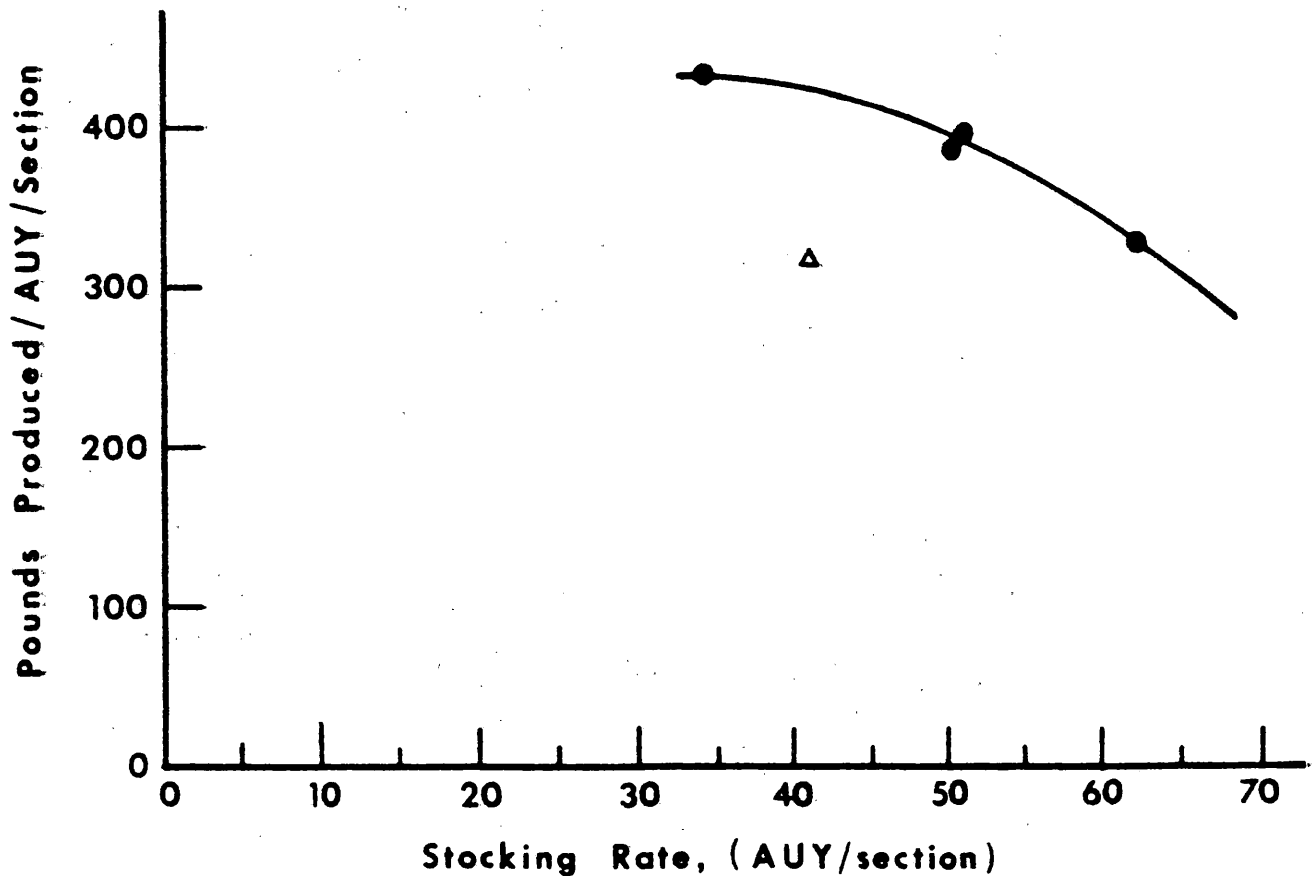


Fig. 3. Mean annual pounds of weaned live weight calf production per AUY/section, from Nov. 1984 to Nov. 1987.

years of the study. Over the four years, the very heavy yearlong grazing treatment averaged 21,120 pounds of weaned calf production per section and 62 AU/Section but most of this production was in 1984 and 1985 (Table 2). The very heavy yearlong pasture only sustained 35 AU/Section of stocking in 1986-87 (Table 1) and produced 15 pounds of weaned calf production per acre (Table 2) or 9,600 pounds per section. The rotated herd produced less weaned calf per section and per animal unit than cows grazed yearlong at comparable stocking rates (Figures 2 and 3).

Vegetation Data

The grazing pattern on the Lehmann lovegrass pastures was very patchy, with Lehmann lovegrass and other species utilized heavily in patches (80%), especially under mesquite and on slopes of draws, and unused in other areas. Specific studies were undertaken to study the tiller growth, production, and nutrient value of Lehmann lovegrass in grazed patches and adjacent ungrazed areas, but the standing crop, species composition, species frequency, and utilization data collected on transects within pastures were very variable.

In fall, 1984, the standing herbage on the upland sites was in excess of 2000 pounds per acre (Table 8) and was near 700 pounds per acre for slopes. Transects on uplands in Pasture 1 in winter of 1987 yielded standing crop data of 300 pounds per acre near the water and near 900 pounds per acre at a mid distance in the pasture. The total standing crop of herbage on the pastures did decrease on all pastures from 1984 to 1987. This was primarily the result of the disappearance of old standing dead herbage, especially on the heavily grazed patches. In 1987 all pastures still showed a very patchy use pattern except for the very heavy yearlong grazing treatment (Pasture 4) and the summer grazed pasture (Pasture 3) which both were utilized relatively uniformly over the upland sites of the pastures. All herbage on the slopes was utilized heavily each year regardless of the grazing treatment.

The data for species composition along transects in Pasture 1 are given in Table 9. These data are similar to data for all pastures. The upland site is dominated by Lehmann lovegrass and false mesquite and the slope site is dominated by grama grasses. These general composition relationships were maintained for all pastures over the study period.

TABLE 8. Standing herbage and current growth on small shrubs as determined by comparative yield estimates on Santa Rita Range lovegrass grazing study. Transect locations are on upland at near, mid and far distance from the cell center, and on a slope side at a mid distance from the cell center. Fall 1984.

PASTURE	Upland				Slope
	Near	Mid	Far	Mean	
1	1529	1698	2536	1921	746
2	3566	2309	3987	3287	472
3					
4	2641	1810	2438	2296	546
5	1955	2635	3160	2583	481
6	1522	2797	2218	2179	1223
7					
Mean	2243	2250	2868	2453	694

TABLE 9. Plant composition determined by dry-weight rank for four transect locations in Lehmann lovegrass study on the Santa Rita Experimental Range. Transect locations are on upland near(N), mid(M), and far(F) from the cell center and on slope side(S) at a mid distance from the cell center. Pasture 1.

SPECIES		Fall 84				Spring 85				Fall 85				Fall 87			
Common name	ABREV	N	M	F	S	N	M	F	S	N	M	F	S	N	M	F	S
LARGE SHRUBS																	
Mesquite	PRJU																
	OTHERS				1												
SMALL SHRUBS																	
False Mesquite	CAER	17	14	37	16	7	14	11		12		26				28	
Snakeweed	GUSA																
Burroweed	HATE																
Range Ratany	KRPA		1		2											5	
	OTHERS				T	1				T							
PERENNIAL GRASSES																	
Three anws	ARIS		T	4	5						10					T	
Sideoats	BOCU			1												1	
B k grama	BOER																
Rock rock grama	BORO				T												
Sprucetop gram	BOCH																
Hairy grama	BOHI		5	14	64							32				47	
Slender grama	BORE																
Ariz. cottonto	DICA			4	T							6				T	
Lehmann lovegr	ERLE	83	79	27	2	91	76	75		86		11				9	
Tanglehead	HECO																
rlly mesquite	HIBE			2	T					1						2	
ains Bristle	SEMA			9													
Sand dropseed	SPCR																
	OTHERS				T		5	12								T	
PERENNIAL FORBS		T	T	1	1						8					7	
ANNUAL GRASSES			T	T	T	T										1	
ANNUAL FORBS		1	T	T	1	1	5	2									

Field Days and Publications

Field Days:

Nov. 15, 1985 - Santa Rita Experimental Range Field Day.
Sept. 26, 1987 - Southern Arizona Livestock Assoc. Field Day.
Nov. 20, 1987 - Santa Rita Experimental Range Field Day.

Theses and Dissertations:

Abu-Zanat, M. (in progress) Cattle Grazing Behavior in Grazed and Nongrazed Patches of Lehmann Lovegrass. Ph.D. Dissertation. University of Arizona.

Gamougoun, D. 1987. Cattle Grazing Behavior and Range Plant Dynamics in Southern Arizona. Ph.D. Dissertation. University of Arizona.

Lin, Ning Hui. 1986. The Use of Large Scale Color Aerial Photographs to Monitor Cattle Grazing in Mesquite Grasslands, Southern Arizona. M.A. Thesis, Department of Geography and Regional Development. University of Arizona.

Nascimento, H. (in progress). Pattern of Utilization and Response of Lehmann Lovegrass (Eragrostis lehmanniana) Grazed by Cattle. Ph.D. Dissertation. University of Arizona.

Abstracts:

Gamougoun, N.D., H. Nascimento, R. Rice, P.R. Ogden, G.B. Ruyle and E.L. Smith. 1987. Cattle grazing time as affected by topographic differences, stocking rate and season in southern Arizona. Soc. for Range Management Annual Meeting, Boise, Idaho. Feb. 8-13, 1987.

Nascimento, H., N. Gamougoun, R. Rice, P.R. Ogden, G.B. Ruyle and E.L. Smith. 1987. Herbage biomass and green biomass of grazed and nongrazed patches in Lehmann lovegrass rangeland as affected by season and stocking rate. Soc. for Range Management Annual Meeting, Boise, Idaho. Feb. 8-13, 1987.

Ogden, P.R., R.W. Rice, E.L. Smith and G.B. Ruyle. 1987. Cattle performance as influenced by stocking rate and seasonal use of Lehmann lovegrass. Soc. for Range Management Annual Meeting, Boise, Idaho. Feb. 8-13, 1987.

Abu-Zanat, M., G.B. Ruyle and R.W. Rice. 1988. Cattle foraging behavior in grazed and nongrazed patches of Lehmann lovegrass. Society for Range Management Annual Meeting. Corpus Christi, Tex. Feb. 21-26, 1988.

Gamougoun, N.D., R.W. Rice, G.B. Ruyle, P.R. Ogden, and H. Nascimento. 1988. Relationships of cattle grazing activities to vegetation and environment. ASAS Annual Meeting. Rutgers University. July 19-22, 1988.

Proceedings

Ruyle, G.B., M. Abu-Zanat and R.W. Rice. 1988. The influence of grazed patches on cattle foraging behavior. Proceedings Western Section Amer. Soc. Anim. Sci. 39:234-236. Pomona, California.

Journal Article:

Ruyle, G.B., Oren Hasson and R.W. Rice. 1987. The influence of residual stems on biting rates of cattle grazing Eragrostis lehmanniana Nees. Applied Anim. Behavior Sci., 19 (1987) 11-17. Elsevier Sci. Pubs. B.V., Amsterdam, Netherlands.